

What is claimed is:

1. A system for anchoring tissue to bone, comprising:

a suture anchor having proximal and distal ends, wherein a suture-engaging tip is present at the distal end of the anchor and a separate, radially expandable sleeve, having a bore formed longitudinally therein, is attached to the suture-engaging tip and forms a proximal end of the suture anchor;

a first loop of suture thread attached to the suture-engaging tip;

a second loop of suture thread interlocked with the first loop of suture thread; and

a suture needle having a first, tissue penetrating end and a second, trailing end, wherein the suture needle is attached to the second loop of suture thread.

2. The system of claim 1, further comprising an expander pin adapted to be inserted into the bore of the sleeve to effect radial expansion of the sleeve.

3. The system of claim 1, wherein the expandable sleeve has two substantially flat, longitudinally extending portions formed on opposite sides of the sleeve, between a proximal end and a distal end of the sleeve.

4. The system of claim 3, wherein a proximal end of the tip includes a first threaded region and a distal end of the sleeve includes a complementary threaded region, enabling the tip to be threadingly connected to the sleeve.

5. The system of claim 4, wherein the proximal end of the tip has an internally threaded bore formed therein.

6. The system of claim 4, wherein the first threaded region of the tip is formed on an outer surface of the tip.

7. The system of claim 6, further comprising an elongate insertion tool having a proximal, handle end, an externally threaded distal end that is matable with the internally threaded bore of the tip, and a shaft that is able to be disposed within the bore of the sleeve in a clearance fit.
- 5 8. The system of claim 7, wherein the expander pin has a longitudinal bore extending therethrough from a proximal end to a distal end thereof, the longitudinal bore having an inner diameter enabling it to be disposed on the shaft of the insertion tool in a first position proximally adjacent to and abutting the sleeve, and selectively moveable to a second position disposed between the shaft and an inner surface of the sleeve in an interference fit with the sleeve.
- 10 9. The system of claim 8, wherein the positioning of the expander pin in the second position causes the sleeve to radially expand from a first outer diameter to a second outer diameter.
- 15 10. The system of claim 9, wherein the difference between the first diameter and the second diameter is in the range of about 1.0 to 1.5 mm.
11. The system of claim 10, wherein the expander pin is formed from a bioabsorbable material.
12. The system of claim 11, wherein the pin is made from a material selected from the group consisting of polylactic acid and polysulfone.
- 20 13. The system of claim 11, wherein the expandable sleeve is formed from a polymeric material.
14. The system of claim 13, wherein the expandable sleeve is made from a material selected from the group consisting of high density polyethylene and polypropylene.

15. The system of claim 1, wherein the tip includes a suture thread-engaging groove for seating a portion of the first loop of suture thread.
16. The system of claim 1, wherein the expandable sleeve comprises at least one external surface feature effective to enhance bone engagement.
- 5 17. The system of claim 16, wherein the at least one surface feature comprises a plurality of ridges.
18. The system of claim 10, wherein the expander pin includes at least one surface feature effective to assist in the radial expansion of the sleeve.
- 10 19. The system of claim 18, wherein the at least one surface feature of the expander pin comprises a plurality of tapered ridges wherein a diameter of the expander pin at a distal part of the ridge is smaller than a diameter of the expander pin at a proximal part of the ridge.
20. A system for anchoring tissue to bone, comprising:
- 15       an expandable base member having a distal end and a proximal end, the proximal end having a bore extending longitudinally therein and at least part of the proximal end being selectively radially expandable;
- a first loop of suture thread attached to the base member;
- a second loop of suture thread interlocked with the first loop of suture
- 20 thread;
- a suture needle having a first, tissue penetrating end and a second, trailing end, wherein the suture needle is attached to the second loop of suture thread;
- and
- an expander pin, selectively disposable within the bore of the base
- 25 member to radially expand the base member from a first outer diameter to a second outer diameter.

21. The system of claim 20, wherein the distal end of the base member includes a suture thread-engaging groove.
22. The system of claim 20, wherein the proximal end of the base member includes two opposed sides, each having a longitudinally extending slit formed therein.
- 5 23. The system of claim 22, wherein the two opposed sides are substantially flat.
24. The system of claim 22, wherein the proximal end of the anchor base has two opposed, radially expandable sides, the radially expandable sides being adjacent to the two opposed sides.
25. The system of claim 24, wherein the two opposed radially expandable sides each  
10 have at least one bone engaging positive surface feature formed therein.
26. The system of claim 24, wherein the bone engaging positive surface feature is a ridge having a distally facing ramped surface and a proximally facing surface with an end wall that is substantially perpendicular to a longitudinal axis of the member base.
- 15 27. The system of claim 26, wherein the expander pin includes wedge-like positive surface features effective to interact with the longitudinally extending slits of the base member to radially expand the proximal end of the base member .
28. The system of claim 20, wherein the bore of the base member has internal threads formed at a distal portion of the bore.
- 20 29. The system of claim 28, further comprising an elongate insertion tool having a proximal, handle end, a distal end with external threads formed therein, wherein the external threads are complementary to the internal threads of the base

member, and a shaft that is able to be disposed within the bore of the base member in a clearance fit.

30. The system of claim 29, wherein the insertion tool further includes a pusher member slidably mounted around the shaft, the pusher member having a distal end proximally adjacent to and abutting a proximal end of the expander pin, such that the pusher member can be selectively advanced to be positioned between the shaft and an inner surface of the proximal end of the base member to effect the radial expansion of the base member.
31. The system of claim 30, wherein the difference between the first diameter and the second diameter is in the range of 1.0 to 1.5 mm.
32. The system of claim 27, wherein the longitudinally extending slits of the base member have a shape complementary to the wedge-like positive surface features of the expander pin and a size sufficient to receive the wedge-like positive surface features.
33. The system of claim 32, wherein positioning the expansion pin within the base member causes an irreversible interlocking of the wedge-like positive surface within the longitudinally extending slits.
34. The system of claim 20, wherein the base member is formed from a bioabsorbable material.
35. The system of claim 32, wherein the bioabsorbable material is selected from the group consisting of polylactic acid and polysulfone.
36. The system of claim 20, wherein the expansion pin is formed from a bioabsorbable material.

37. The system of claim 36, wherein the bioabsorbable material is selected from the group consisting of polylactic acid and polysulfone.

38. A suture anchor, comprising:

5 a distal component having a suture thread-engaging groove formed therein;

a proximal component having an external surface with at least one positive surface feature formed thereon, at least a portion of the proximal component being selectively radially expandable; and

10 a bore extending into the proximal component of the suture anchor from the proximal end thereof, the bore being parallel with a longitudinal axis of the suture anchor.

39. The suture anchor of claim 38, wherein the distal component includes a tip, and the distal component is separate from the proximal component.

40. The suture anchor of claim 39, wherein the distal component and the proximal component are threadingly engaged with each other.

41. The suture anchor of claim 40, wherein a through-hole extends through the tip in a direction transverse to the longitudinal axis.

42. The suture anchor of claim 39, wherein the bore extends entirely through the proximal component of the suture anchor from a proximal end to a distal end thereof.

43. The suture anchor of claim 42, wherein an external surface of the proximal component includes at least one positive surface feature.

44. The suture anchor of claim 43, wherein the at least one positive surface feature comprises a plurality of wedge-like fins.

45. The suture anchor of claim 44, wherein each wedge-like fin has a ramped surface distal of a distal facing endwall that is substantially transverse to the longitudinal axis of the suture anchor.
- 5 46. The suture anchor of claim 45, wherein the suture anchor further comprises a separate expansion element having an outside diameter sufficient to fit within the bore of the proximal component in an interference fit to cause the proximal component to radially expand.
- 10 47. The suture anchor of claim 46, wherein the external surface of the expansion element has at least one positive surface feature effective to assist in the radial expansion of the proximal component from the first diameter to the second diameter.
48. The suture anchor of claim 47, wherein the positive surface feature is a wedge-like structure having a proximal portion that is raised relative to a distal end thereof.
- 15 49. The suture anchor of claim 48, wherein a distal portion of the bore includes internal threads.
50. The suture anchor of claim 39, wherein the tip is made from a material selected from the group consisting of polylactic acid and polysulfone.
- 20 51. The suture anchor of claim 39, wherein the proximal component is made from a material selected from the group consisting of high density polyethylene and polypropylene.

52. The suture anchor of claim 46, wherein the expansion element is bioabsorbable and is made from a material selected from the group consisting of polylactic acid and polysulfone.
53. The suture anchor of claim 47, wherein the difference between the first diameter and the second diameter is in the range of about 1.0 to 1.5 mm.
54. The suture anchor of claim 38, wherein the distal and proximal components of the suture anchor are made from the same material and are integral with each other.
55. The suture anchor of claim 54, wherein a through-hole extends through the tip in a direction transverse to the longitudinal axis.
56. The suture anchor of claim 54, wherein the proximal end of the proximal component has longitudinally extending slits formed therein on opposite sides of the proximal component.
57. The suture anchor of claim 54, wherein the bore terminates proximal of the through-hole and does not communicate with the through-hole.
58. The suture anchor of claim 57, wherein an external surface of the proximal component includes at least one positive surface feature.
59. The suture anchor of claim 58, wherein the at least one positive surface feature comprises a plurality of wedge-like fins.
60. The suture anchor of claim 59, wherein each wedge-like fin has a ramped surface distal of a distal facing endwall that is substantially transverse to the longitudinal axis of the suture anchor.



- 5 61. The suture anchor of claim 56, wherein the suture anchor further comprises a separate expansion element having an outside diameter sufficient to enable the expansion element to fit within the bore of the proximal component in an interference fit to effect radial expansion of the proximal component from a first diameter to a second diameter.
62. The suture anchor of claim 61, wherein the external surface of the expansion element has at least one positive surface feature effective to assist in the radial expansion of the proximal component from the first diameter to the second diameter.
- 10 63. The suture anchor of claim 62, wherein the expansion element has at least two positive surface features on opposite sides of the expansion element and each positive surface feature includes at least one wedge-like structure having a proximal portion that is raised relative to a distal end thereof.
- 15 64. The suture anchor of claim 63, wherein each of the at least one wedge-like structures is complementary in shape to the slits of the suture anchor.
65. The suture anchor of claim 61, wherein each of the at least one wedge-like structures has dimensions that enable it to fit within and irreversibly interlock with the slits of the suture anchor.
- 20 66. The suture anchor of claim 61, wherein the difference between the first diameter and the second diameter is in the range of about 1.0 to 1.5 mm.
67. The suture anchor of claim 54, wherein the suture anchor is made from a material selected from the group consisting of high density polyethylene and polypropylene.
68. The suture anchor of claim 54, wherein the expansion pin is bioabsorbable.

69. The suture anchor of claim 68, wherein the expansion pin is made from a material selected from the group consisting of polylactic acid and polysulfone.